# Digital Earths Lighthouse Activity
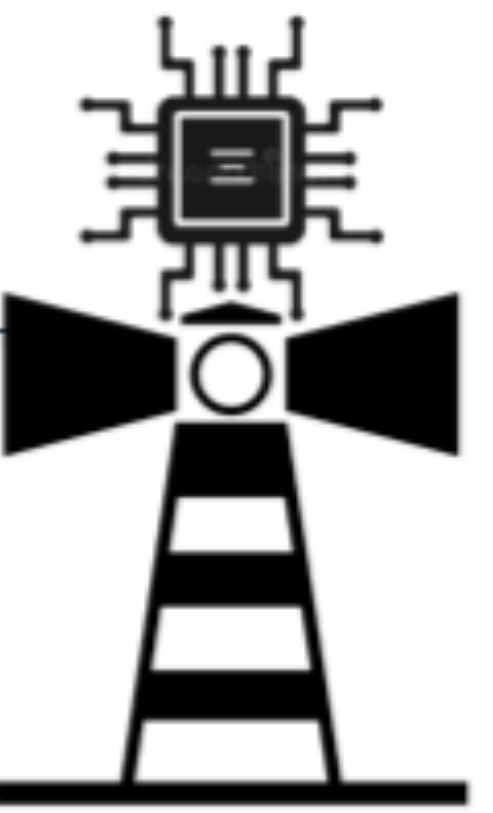
**Digital Earths = horizontal, cutting across other LHA!**



DRAFT WCRP Lighthouse Activities

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# Why this one?

Break-throughs:

1. <u>Extreme-scale computing and data handling</u>:
   = *much more realistic models + better combination of simulations + observations*

2. <u>Full integration of policy sectors</u> in monitoring and prediction workflow
   = *Earth-system + energy + food + water + finance*

3. <u>Open and interactive access</u> to data, software and workflows for users
   = *non-expert access and intervention*



At 1-kilometer resolution, a European climate model (left) is nearly indistinguishable from reality (right). (LEFT TO RIGHT) ECMWF; © EUMETSAT

Europe is building a 'digital twin' of Earth to revolutionize climate forecasts

By **Paul Voosen** | Oct. 1, 2020, 10:40 AM

**NewScientist**

Building digital twins of Earth could help Europe cut carbon emissions

ENVIRONMENT 12 October 2020

By Adam Vaughan

**nature COMMUNICATIONS**

COMMENT

https://doi.org/10.1038/s41467-020-16624-8      OPEN

New priorities for climate science and climate economics in the 2020s

David A. Stainforth [1,2,3] & Raphael Calel [1,4]

# Digital Earth objectives & scope

**Digital Earths is a:**
- digital and dynamic representation of the Earth system;
- optimal blend of models and observations;
- enable exploration of past, present and possible futures of the Earth system;
- give open access to data, methodologies and software;
- create innovation in in support of the WCRP Objectives;
- push co-development of modelling with digital technologies HPC, BD & ML;
- key instrument to achieve the goals of the other Lighthouse Activities.

**Digital Earths will be a:**
- joint activity with existing/novel, technology driven national and international projects;
- WCRP will implement selected versions for topics where significant progress is required (e.g. other LHA)

**The core of Digital Earths is to:**
- develop generic software-hardware solutions that allow simulation models and data assimilation to perform several orders of magnitude more efficiently;
- facilitate the extraction of Earth-system sector specific information from vast amounts of environmental data, both simulated and observed;
- allow to invest efficiency gains in upgrading simulations, ensembles and/or running more comprehensive scenarios.

# A framework rather than an implementation

- Digital Earths in WCRP should be a **FRAMEWORK** to develop activities across the globe.

- This requires to create science activities whose software outcomes are: **open and freely available, modular and interoperable, and built to agree upon standards**.

- We envisage both **global and regional** Digital Twins to be developed under this Framework

GLOBAL
e.g., Destination Earth

REGIONAL
e.g., Digital Vietnam

LOCAL
e.g., Digital Buenos Aires

Modelling
(WGNE, WGCM ...)

Observations and
Data Assimilation
(WWRP DAOS ...)

Digital
Earths

Software Design and
Machine Learning
(WMO RB?)

User Interaction
And Co-Design
(Future Earth ...)